

## Chapter 3

# Tank Weapon Gunnery Simulation System (TWGSS)

TWGSS is the primary gunnery training device for the Abrams-series tank. The TWGSS is a tank-mounted training device that aids the crew in gaining and improving proficiency in gunnery skills without the expenditure of live ammunition. Precision gunnery training using TWGSS can be conducted at any training site that eye-safe laser firing is permitted. TWGSS provides the crew with visual and sound effects that accurately simulate real firing conditions. The system simulates the firing of the tank's main gun, the firing of the M240 machine gun, and the effects of a hit on target.

## TWGSS Components

The TWGSS system consists of three major subsystems, the firing system, the target system, and the Training Data Retrieval System (TDRS). These major subsystems perform functions within the system as a whole.

### FIRING SYSTEM

The firing system simulates the ballistic characteristics for the ammunition being fired and provides the visual and sound effects.

### TARGET SYSTEM

The target system receives and processes data from another entity equipped with a laser training device and informs the crew of the results of the attack on own vehicle. The attack could come from another TWGSS-equipped tank, a Precision Gunnery System (PGS)-equipped Bradley, or a Multiple Integrated Laser Engagement System (MILES)-equipped unit. An observer controller can also communicate with the TWGSS target system using a control gun.

### TRAINING DATA RETRIEVAL SYSTEM

The TDRS provides real-time analysis for each round fired. This information provides critical data for use in conducting an after-action review for both gunnery-type scenarios, and tactical training environments.

## TWGSS Individual Components

The individual components of the TWGSS system and a brief description of the functionality of each component are shown below.

- The *transceiver unit* performs the complete weapon effect simulation, to include point of impact, type of ammunition fired, and identity of firing vehicle to the target.

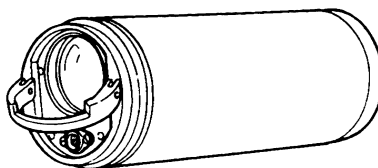
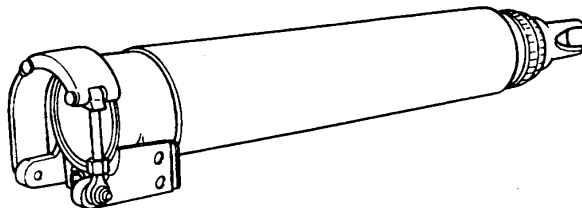


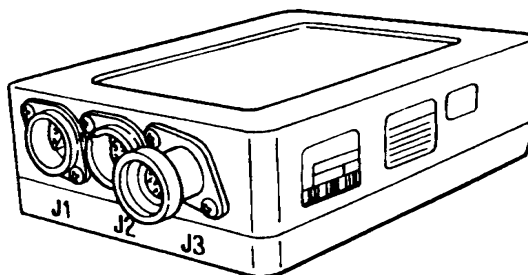
Figure 3-1. Transceiver unit.

- The *tracer, burst, obscuration simulator (TBOS)* projects tracer, burst, and obscuration effects simulation into the gunner's auxiliary sight (GAS).



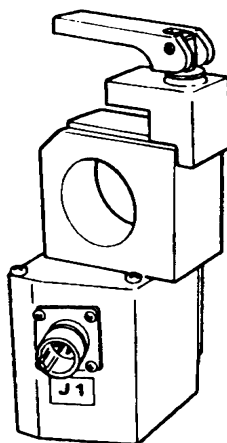
**Figure 3-2. Tracer, burst, obscuration simulator.**

- The *TBOS driver unit* provides image data for the type of ammunition being fired and, if hit, provides burst image data to the TBOS GAS unit.



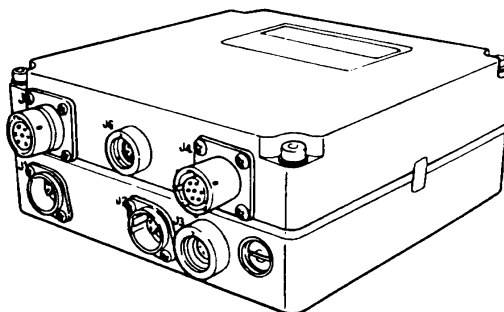
**Figure 3-3. TBOS driver unit.**

- The *turret position sensor (TPS)* senses the turret position in relation to the hull and sends this information to the vehicle interface unit.



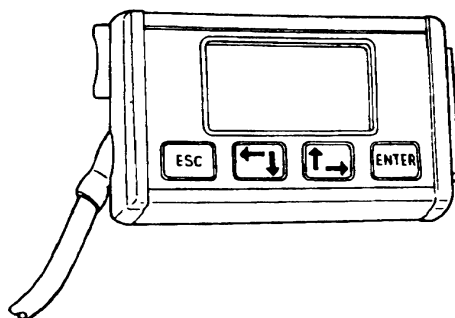
**Figure 3-4. Turret position sensor.**

- The *vehicle interface unit* receives electrical power from the tank and distributes power to system components.



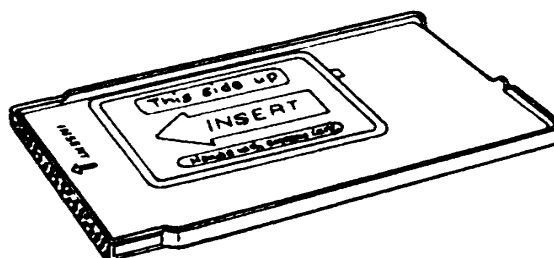
**Figure 3-5. Vehicle interface unit.**

- The *control panel* is the soldier's TWGSS system interface for inputting data. Entries into the control panel include:
  - Upload ammunition.
  - Select training modes.
  - Operate system during training.
  - Align system prior to training.
  - View results of engagements.
  - View built-in test (BIT) results.



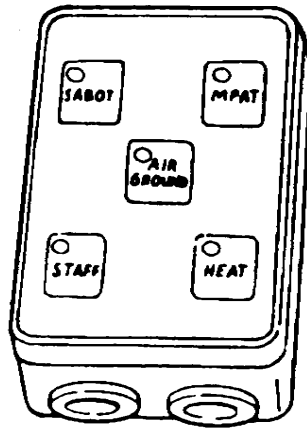
**Figure 3-6. Control panel.**

- The *TDRS memory card* stores firing and target data for the type of vehicle being used and the type of training being conducted. It collects and stores training events in real time during the TWGSS training for retrieval and use during the AAR using the TDRS computer unit.



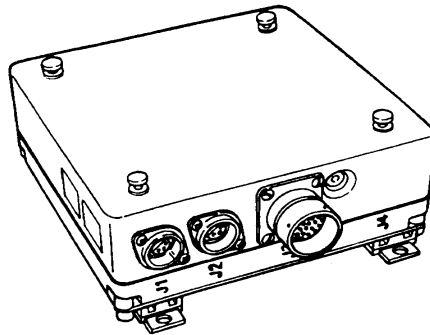
**Figure 3-7. TDRS memory card.**

- The loader's panel allows the loader to select the type of ammunition being loaded, and provides the aural cues associated with loading the main gun.



**Figure 3-8. Loader's panel.**

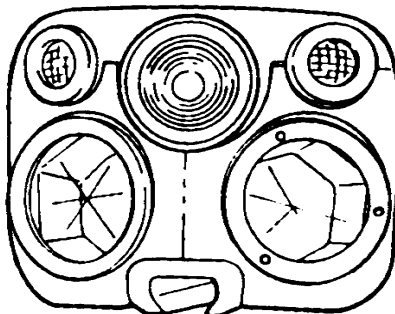
- The TBOS video-mixer unit provides video-generated obscuration, tracer, and target effects for the gunner's primary sight (GPS) in both daylight and thermal modes.



**Figure 3-9. TBOS Video-mixer unit.**

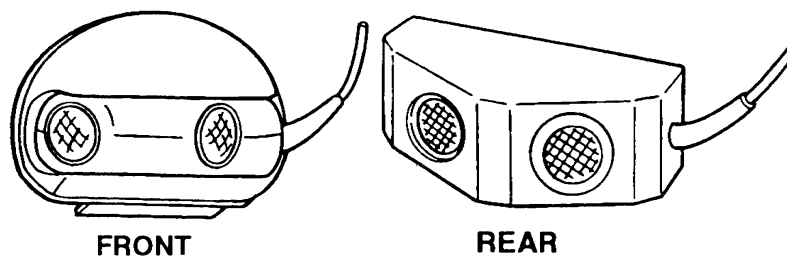
- The retrodetector unit consists of two reflectors, two laser detectors, and one strobe light. The reflectors reflect laser light to the firing TWGSS or PGS. The laser detectors receive hit information, including type of ammunition, identity of attacker, and hit point on own vehicle. The strobe light flashes when the tank has been hit.

**Note.** For placement of target panel retrodetectors, refer to TM 9-6920-703-10.



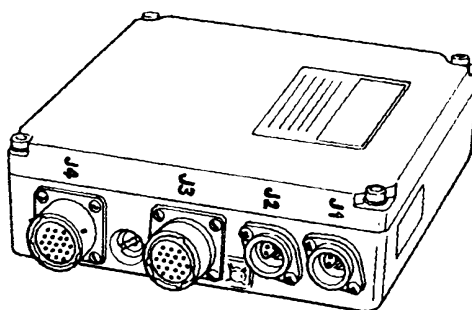
**Figure 3-10. Retrodetector unit.**

- The hull defilade detector unit detects a hit to the hull of the tank, when exposed.



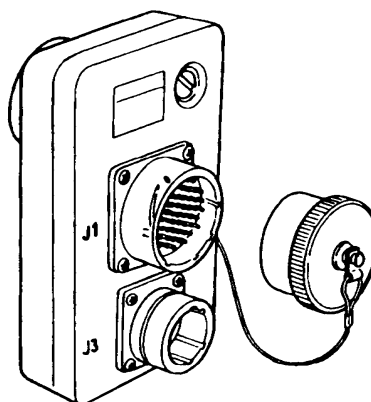
**Figure 3-11. Hull defilade detector unit.**

- The target computer unit receives the results of a simulated firing, including hit point, type of ammunition, and identity of the firing system. The computer also determines if there was a near miss, hit, mobility kill, weapon kill, catastrophic kill, or no effect.



**Figure 3-12. Target computer unit.**

- The TIS junction box provides a connecting point for the electrical input from the TBOS video-mixer unit to enter the TIS image control panel.



**Figure 3-13. TIS junction box.**

# TWGSS Capabilities and Limitations

## CAPABILITIES

The TWGSS provides full-crew interactive training on the actual vehicle utilizing the complete functionality of the fire control system (FCS). The system utilizes the axis of the gun line in conjunction with the firing tables to determine the trajectory and impact point for the type of ammunition being fired. The system is fully interoperable with the PGS, MILES, Laser Target Interface Device (LTID), and the Improved Tank Gunfire Simulator (ITGS).

The system simulates the following visual effects:

- Tracer.
- Burst on target.
- Burst on ground.
- Obscuration.

The system provides the following aural cues to the crew via the intercom:

- Main gun firing.
- M240 machine gun firing.
- Hit indication.
- Ammunition loading.
- System error tone.

TWGSS also provides panel gunnery training, target tracking training, scaled-target training, and realistic force-on-force training with immediate feedback.

Degraded-mode gunnery while using TWGSS requires no additional inputs from the crew. The system has its own embedded sensors that will identify any inoperative portions of the FCS and require the crew to react to the malfunction in the appropriate manner to still hit targets.

## SYSTEM LIMITATIONS

In order to conduct manual- and emergency-mode gunnery training, the turret power must remain on to provide power for the TWGSS components.

**Note.** The main gun can be fired using the manual blasting machine and the hydraulic elevation handle trigger to simulate degraded-mode gunnery engagements.

## TWGSS Training

The TWGSS train-up program is a train-the-trainer-type program. The certification course is a 40-hour block of instruction. Once an individual has been certified on TWGSS and has his certificate of training, he is then certified to teach the certification course to others. It is recommended that a certification course be taught quarterly, as a minimum, to ensure that every unit has plenty of personnel trained on the system.

Before conducting a training event using TWGSS, a refresher training block of instruction should be scheduled to ensure all soldiers are still proficient in installation, operation, and AAR. A well-trained tank crew can install TWGSS in about 45 minutes, as well as have fewer instances of lost training time due to crew error and damaged equipment.

Conducting training with TWGSS should be scheduled as often as possible within a unit's gunnery training program. This will ensure that the crew's proficiency level with the FCS will not deteriorate over time and will help guarantee a continuous gunnery training cycle.

## HOME-STATION TRAINING

Before conducting training that requires ranges or training areas, TWGSS can be used at home station to conduct target tracking and engagement techniques. If the land available at home station is not large enough to support full-scale target engagement ranges, training can be conducted using half-scale targetry. This training is ideally suited to be conducted in conjunction with the refresher training on utilizing TWGSS.

## RANGE TRAINING

In its role as the primary precision gunnery trainer, TWGSS is the resourced device by STRAC for many of the tank gunnery tables and tactical tables. When the system is set up for panel gunnery, it provides the crews with the capability to engage targets on a range complex in the same manner as if they were firing live ammunition and provides immediate feedback for use during an AAR.

The following tank tables should be conducted using TWGSS:

- Tank Table IV.
- Tank Table VI.
- Tank Table VII (dry runs).
- Tank Table XI.

TWGSS has the ability to train using various scaled targets. The trainer has the option to use full-scale, half-scale, or 1/10-scale targets, depending on the resources and ranges available. If a full-size range is available, the trainer can use the full- or half-scale target options. The 1/10-scale target option is used when resources and range constraints exist. The 1/10-scale targets can be used in local training areas.

**Note.** All tank tables can be trained using TWGSS, but qualification tables must be fired using live ammunition in order for a crew or platoon to be considered qualified.

## FORCE-ON-FORCE TRAINING

If the number of TWGSS systems available to a unit is sufficient to support force-on-force training, it should be the preferred device to use. Although MILES is the resourced device, it does not utilize the tank's FCS in a precision-gunnery role. Reinforcing precision gunnery skills at all levels of training should be conducted whenever possible.

## AFTER-ACTION REVIEW

The TWGSS TDRS computer provides the means by which the information collected by the TDRS memory card is formatted into an effective AAR. The TDRS computer unit enables the instructor to set up, control, and evaluate training exercises. The system supports AARs for both panel gunnery mode and force-on-force mode. The major event categories captured for use on the TDRS computer for replay during an AAR are:

- Targeting events.
- Firing events.
- Movement events.

The AAR can be prepared and ready to run by a trained operator within 15 minutes.

## System Information

For more information about the TWGSS system, to include future upgrades, contractor logistical support (CLS), and general information, contact the Chief, Systems Branch (Armor Training Devices), DTDD, Fort Knox, KY, (DSN) 464-5656, (Commercial) 502-624-5656.